

NOTES ON THE FLORA OF GUADALUPE ISLAND,
MEXICO

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Guadalupe Island lies 250 miles south of San Diego, California, and 160 miles off the coast of Baja California, Mexico. Since the flora of Guadalupe Island is related to that of California and especially to that of the Californian islands, a former land connection to the north has been suggested. But the island is volcanic in origin and is now separated from the mainland by depths of more than 2000 fathoms: it probably has never been connected with other land areas.

Two monotypic genera, *Baeriopsis* and *Hesperelaca*, are endemic to Guadalupe Island; and two other groups sometimes treated as genera, *Nesothamnus* and *Petromecon*, are also endemic. Of the 151 species of vascular plants that probably are native, about 34 species, or 22.6 per cent, are endemic. An additional 17 species, or 11.3 per cent, are insular endemics, mostly recurring on the Californian islands to the north. The number of endemics of course cannot be exactly stated without an evaluation of each species.

Eastwood (1929) summarized botanical explorations of Guadalupe Island up to that time and listed the species collected. The only additions since published are by Howell (1942).

In April of 1948, George Lindsay and I visited Guadalupe Island with Mr. and Mrs. Lewis Cavanagh in their ketch, the *Marviento* (Moran and Lindsay 1950). We collected at Northeast Anchorage, at the pine grove, and at the south end—all localities previously visited by several botanists. In addition, we collected on Outer Islet, whose flora has not been reported before. George Lindsay again collected on Outer Islet on January 27, 1950.

Outer Islet is a volcanic crater about two miles south of the main island. Cliffs 400 feet or more in height rise sheer from the sea to the crater's rim. Only on the north side, where the rim dips lowest, do the vertical cliffs give place to a scalable slope; and here, too, a small cove gives some shelter against the western swell. Within the crater, a few feet below the low point of its rim, is a flat floor of alluvium perhaps two acres in extent, sparsely covered with low vegetation. From this floor the inner slopes of the crater rise rather uniformly at about 45°. An irregular network of crevices, dividing the surface into large plates, gives foothold to more low-growing plants.

Though Outer Islet is rather barren and has little variety of habitats, it is at least free from the plague of goats which on the main island has reduced many species of plants nearly or quite to extinction. In our brief time on Outer Islet, we found 30 species of plants. Two were undescribed and five others were previously

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unreported from Guadalupe Island. Ten (including the new species) are known only from Guadalupe Island, and seven others are insular endemics. Because of the goats, several of these species probably are now rare if not extinct on the main island.

The first set of my specimens is in the Dudley Herbarium of Stanford University (DS). Field numbers are mine unless otherwise indicated. George Lindsay's specimens are at the San Diego Museum of Natural History.

PLANTS OF OUTER ISLET

DICHELOSTEMMA PULCHELLUM (Salib.) Heller. Infrequent on the inner slope (2936).

ATRIPLEX BARCLAYANA (Benth.) Dietr. Common on the inner slope and floor of the crater (2929).

A. CALIFORNICA Moq. North outer slope (2946).

ERIOGONUM MOLLE Greene. Occasional on the inner slope, but without flowers (2927). Previously known only from Cedros Island, Baja California.

MIRABILIS LAEVIS (Benth.) Curran. Occasional on the inner slope (Lindsay 1815).

MESEMBRYANTHEMUM CRYSTALLINUM L. Common on the crater floor.

TALINUM GUADALUPENSE Dudley. Common on the crater floor, just coming into leaf and flower (2942). Also abundant on a black lava rock about 100 yards offshore and easterly of the southernmost point of the main island (2867). An exact locality for this plant has not previously been given. Although originally described as rhizomatous, it is a succulent shrub about 5 dm. high. For photographs and a description, see Moran and Lindsay 1950.

SPERGULARIA MACROTHECA (Hornem.) Heynh. Occasional on the inner slope (2928).

ESCHSCHOLZIA PALMERI Rose. A few plants on the north outer slope (2945).

ERYSIMUM INSULARE Greene. Occasional on the inner slope (2935). Previously known only from San Miguel and Santa Rosa islands, California.

Dudleya guadalupensis, sp. nov. Caudex diametro $1\frac{1}{2}$ – $3\frac{1}{2}$ cm. multiramisus, rosulae foliis 35–75 oblongo-ob lanceolatis apiculato-acuminatis $2\frac{1}{2}$ – $6\frac{1}{2}$ cm. longis 8–13 mm. latis, caulibus floriferis sinuosis 2–3 dm. longis, calycis tubo 1 – $1\frac{1}{2}$ mm. longo, petalis lineari-lanceolatis acutis 11–13 mm. longis 2 – $2\frac{1}{2}$ mm. latis basi 1–2 mm. connatis valde carinatis fere rectis adscendentibus sed non vere erectis inter se non contingentibus, carpellis suberectis sed separatis maturis adscendentibus.

Caudex $1\frac{1}{2}$ – $3\frac{1}{2}$ cm. thick, becoming 10 cm. or more long, branching to form rounded clumps of 60 or more rosettes; rosettes subglobose, 3–6 cm. in diameter, of 35–75 leaves, the outer leaves erect or somewhat incurved over the inner; rosette

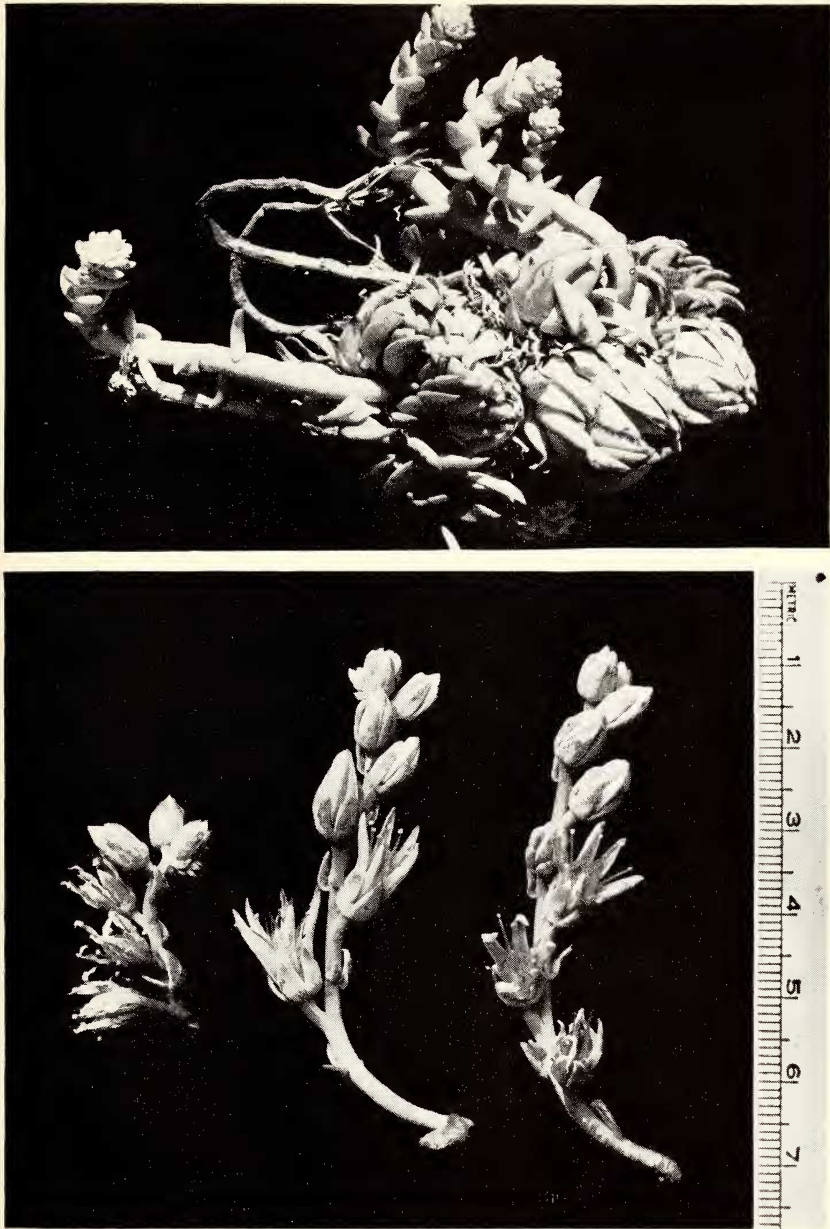


PLATE 3. *DUDLEYA GUADALUPENSIS*, Above: Rosettes with young floral stems and remnants of old ones; photographed April 18, 1948, two days after collection. Below: Cincinni produced by detached floral stems; photographed June 22, 1948.

leaves not glaucous, oblong-ob lanceolate, apiculate-acuminate, $2\frac{1}{2}$ – $6\frac{1}{2}$ cm. long, 8–13 mm. wide, 2–3 mm. thick, the base 4–8 mm. wide, the margins rounded; floral stems glaucous, sinuous, 2–3 dm. long, 4–7 mm. thick, with about 15–35 leaves, leafless in the lower 5 cm.; cauline leaves glaucous, ascending, triangular-ovate, acute, the lowermost 1–2 cm. long, 7–10 mm. wide; inflorescence glaucous, of 2–3 ascending simple or bifurcate branches, the cincinni 4–8 cm. long, with 7–12 flowers; pedicels erect, the lower 3–5 (–8) mm. long, the upper 2–3 mm. long; calyx 5–6 mm. wide, 6–8 mm. high, rounded below, the tube 1– $1\frac{1}{2}$ mm. long, the segments narrowly triangular-ovate, acute, slightly unequal, 3–5 mm. long, $2\frac{1}{2}$ – $3\frac{1}{2}$ mm. wide; petals white, somewhat greenish along the keel, linear-lanceolate, acute, 11–13 mm. long, 2– $2\frac{1}{2}$ mm. wide, connate 1–2 mm., strongly keeled, nearly straight, ascending, not touching each other above the calyx, the corolla about 4 mm. in diameter at the base and 7–11 mm. in diameter above; stamens erect, with filaments about 9 mm. long, the epipetalous adnate 2– $2\frac{1}{2}$ mm., the antisepalous adnate 1– $1\frac{1}{2}$ mm.; anthers yellow, about 1 mm. long; scales whitish, 1 mm. or more wide; carpels nearly erect but separated, or bowed outward with the styles connivent, the ovaries about 4–6 mm. long, the styles at first about 2 mm. long, becoming 3–4 mm. long in the fresh material; mature follicles ascending, the ventral margins about 60 – 75° above horizontal. Chromosome number: $n = 17$.

Type. Outer Islet, Guadalupe Island, April 16, 1948, Moran 2947 (DS 324267, 324268).

At the time of collection, the rosettes had about 35 to 70 leaves and were very compact, the outer leaves being tightly folded over the inner. Immature leaves less than 2 cm. long were numerous, making up about half the total number; and they were nearly equal in size rather than grading evenly from youngest to mature, as is usual in *Dudleya*. The date of collection was perhaps near the end of the growing season: probably the number of leaves was then about maximum, many of the leaves of the next season having already been formed. In cultivation in California, the rosettes look quite different. The number of leaves is about 25 to 40, the outer leaves are ascending rather than incurved, and the gradation from small to large leaves is more even. At the native locality the appearance of the rosettes doubtless varies with the season.

No species of the subgenus *Stylophyllum* has flat thin leaves like those of *D. guadalupensis*. The leaves of *D. formosa*, *D. Traskiae*, and *D. virens* may be quite broad relative to their thickness; but if so, they are much broader and thicker and often much longer than those of *D. guadalupensis*. The leaves of *D. guadalupensis* seem more typical of *Eududleya*; in particular, they resemble those of *D. linearis*, which is endemic to the San Benito Islands, Baja California.

The tortuous floral stem of *D. guadalupensis* seems to be unique in the genus. All plants seen, amounting perhaps to a hundred or more, showed this character in the young floral stems and in those remaining from previous seasons.

The specimens were collected about a month before the time of flowering. Young floral stems continued to develop but became somewhat etiolated before they were unpacked. The first flowers were abnormal because of etiolation, but younger buds produced flowers that appeared more normal. Plants grown at four localities in California failed to flower in 1949, 1950, and 1951. The description of inflorescence and flowers, therefore, is based upon old floral stems collected on Outer Islet and upon the fresh material of 1948, which appears to be normal, but which in some respects may not be so.

In *D. guadalupensis* the calyx tube is 1 to 1½ mm. long. In *D. rubens* apparently the tube may be 1 mm. long. But in most other species there is scarcely more than a suggestion of a calyx tube.

The petals of *D. guadalupensis* are long and narrow, ascending, strongly keeled, nearly straight, and not in contact with each other above the calyx. They are longer and relatively narrower than in any species of *Stylophyllum*. In most species of *Stylophyllum* the petals are widespreading from near the middle. In those with relatively erect petals, as also in the species of *Eududleya*, the petals are in contact with each other well above the calyx.

Thus *Dudleya guadalupensis* appears to differ from other species of *Dudleya* in its twisted floral stems and in its somewhat united sepals. It differs from *Stylophyllum* in its numerous small thin leaves in dense rosettes and in its long, narrow, straight, strongly keeled petals. And it differs from *Eududleya* in its separated petals and from most species also in its ascending predehiscent carpels.

Dr. Charles H. Uhl of Cornell University studied the type collection and found a gametic chromosome number of 17.

LOTUS ORNITHOPUS Greene. Occasional on inner slope (2924).

EUPHORBIA MISERA Benth. Common on the crater floor and occasional on the inner slope (2939). Not previously reported from Guadalupe Island.

RHUS INTEGRIFOLIA (Nutt.) B. & H. Occasional on the inner slope and one patch on the crater floor; without flowers or fruit (2932). Not previously reported from Guadalupe Island.

LAVATERA OCCIDENTALIS S. Wats. Common on the inner slope (*Lindsay 1803, Moran 2930*). In April 1948 this was in fruit, and in January 1950 George Lindsay collected it in flower.

The species as it occurs on Outer Islet may be described as follows: herbage very sparsely stellate puberulent, only the calyx densely so; leaf blades 6–12 cm. wide, lobed about one-third of the way to the base, the lobes rounded or narrower, coarsely

crenate; petioles 4–14 cm. long; petals cream-colored to pale green with deep purple veins, widespreading, 4–6 cm. long. The flowers agree well with those of previous collections from Guadalupe Island. However, the lobes of the leaves are shorter and more rounded and the puberulence is sparser.

Lavatera insularis S. Wats., of the Coronado Islands, is here referred to *L. occidentalis*, which is therefore scratched from the list of Guadalupe Island endemics. The collections seen from the Coronado Islands are quite uniform and perhaps came from one small area on the west slope of the southern island. Collections from Guadalupe Island are variable in leaf shape, but some of them closely match the specimens from the Coronado Islands. Greene (1885) said that the flowers of *L. insularis* were exactly those of *L. occidentalis*, and so it appears. There remains only the slight difference in the degree of fusion of the involucre bracts.

Lavatera Lindsayi sp. nov. Frutex circa 3 dm. altus pube stellata velutinus, foliis rotundo-cordatis 4–9 cm. latis vadoso 7-lobatis, lobis rotundatis crenatis, petalis purpureis spatulatis emarginatis erectis adscendentibusve 3–5 cm. longis. Priori valde affinis sed pube densiore foliis minoribus vadosius lobatis petalis purpureis erectis differt.

Shrub about 3 dm. tall. Herbage velvety with a dense stellate puberulence. Leaf blades round-cordate with the sinus nearly closed, 4–9 cm. wide, seven-lobed one third of the way to the base or less, the lobes rounded, coarsely crenate; petioles 2–5 cm. long. Pedicels several in the upper axils, nearly equalling the flowers. Involucre 1–1½ cm. long, of 3 oblong rounded bracts united in the lower third. Calyx about 2 cm. long, divided to the middle into triangular-ovate acute or acuminate segments. Petals deep purple throughout, spatulate, emarginate, erect or slightly ascending but not widespreading, 3–5 cm. long. Fruit not seen.

Type. North outer slope of Outer Islet, Guadalupe Island, April 16, 1948, *Moran 2944* (DS 325397); distributed as *L. occidentalis*. Collected at the same place by George Lindsay (1812); both collections in flower.

Lavatera Lindsayi is close to *L. occidentalis*, differing in denser puberulence, smaller and more shallowly lobed leaves, and more erect purple petals. The relationship of the two is puzzling. On Outer Islet they appear quite distinct. Since they grow near together and since their flowering times overlap, the apparent lack of intermediates suggests incompatibility. Moreover, plants of *L. occidentalis* on Outer Islet are even less puberulent than other collections of *L. occidentalis* and agree with them in floral characters; thus in these respects *L. occidentalis* of Outer Islet shows no approach toward *L. Lindsayi*. These facts suggest that the two plants are best regarded as separate species. Yet it seems remarkable that of all the collections of *L. occidentalis*, those from Outer Islet most closely approach *L. Lindsayi* in leaf shape.

With regard to the difference in flower color, it may be of interest that in *L. assurgentiflora* Kell. on Indian Rock, off Santa Catalina Island, I saw (and recorded in color photographs) two color phases on adjacent plants that otherwise were essentially identical.

SPHAERALCEA PALMERI Rose. Occasional on the crater floor, without flowers or fruit (2943).

CROSSOSOMA CALIFORNICUM Nutt. Only one small shrub seen, on the inner slope (2938).

MAMMILLARIA BLOSSFELDIA Bödeker var. *SHURLIANA* Gates. One specimen on the crater floor (*Lindsay* 540). Also seen at the south end of the main island. Determined by George Lindsay. This is the plant reported from Guadalupe Island as *M. Goodridgei* Scheer.

LOMATIUM INSULARE (Eastw.) Munz. Occasional on the inner slope (2933). Also occasional on the mesa above the southwest point of the main island (2854). Determined by Mathias and Constance. Previously known only from San Nicolas Island, California.

CONVOLVULUS MACROSTEGIUS Greene. Occasional on the inner slope (2921).

CRYPTANTHE FOLIOSA Greene. Infrequent on the inner slope (2941).

LYCIUM CALIFORNICUM Nutt. Common on crater floor (2940).

CASTILLEJA GUADALUPENSIS Brandegee. Occasional on the inner slope (2922).

GALVEZIA SPECIOSA Nutt. Occasional on the north and inner slopes (2937).

BAERIOPSIS GUADALUPENSIS J. T. Howell. Occasional on the north and inner slopes (2934). Previously known only from the type collection, from the south end of Guadalupe Island.

COREOPSIS GIGANTEA (Kell.) Hall. Common on the crater floor and the inner slope (2923). Two flower heads shot down from the cliffs of Inner Islet (2868).

HEMIZONIA GREENEANA Rose. Common on the inner slope (2925). Not in flower here, and flowering very scantily at the south end of the main island.

PERITYLE INCANA Gray. Common on the inner slope (2931). Not in flower here though flowering on cliffs above Northeast Anchorage.

STEPHANOMERIA GUADALUPENSIS Brandegee. Occasional on the inner slope, without flowers; juice milky orange (2926). Determined by J. T. Howell.

NOTEWORTHY PLANTS OF THE MAIN ISLAND

BROMUS MOLLIS L. Occasional in the canyon mouth at Northeast Anchorage (2881). Not previously reported from Guadalupe Island.

TRITELEIA LUGENS Greene. North-facing basaltic cliff at about 3500 feet elevation at the north end of the island (2914). Collected by Brandegee in Sparmanns Canyon.

DUDLEYA sp. Same locality; only a single clump found (2915). This resembles members of the *D. caespitosa* complex, but without flowers it cannot be surely assigned even to subgenus. For a photograph, see Moran and Lindsay 1950.

JEPSONIA PARRYI (Torr.) Small. Same locality (2917). When collected in April, the plants bore leaves but no flowers; at the Rancho Santa Ana Botanic Garden in August 1950, they flowered while leafless. Clearly this is the same as the sterile specimens in the Herbarium of the University of California collected on Guadalupe Island by Brandegee in 1897 and by Drent in 1898. The species has not previously been reported from Guadalupe Island, unless it is the "*Heuchera?*" reported from sterile material collected by Palmer and by Franceschi.

In the three collections from Guadalupe Island, the rhizome is 5 to 12 mm. thick and the leaves are mostly 4 to 8 cm. wide. In specimens from the islands and mainland of southern California, the rhizome (except for a thicker basal corm) is about 1 to 6 mm. thick, and the leaves are 2 to 6 cm. wide. The flowers of the Guadalupe plant are similar to those of several collections from southern California. The hypanthium including the sepals is 3 to 4 mm. long, and the sepals are about $\frac{1}{2}$ to 1 mm. long.

RUTA GRAVEOLENS L. Three sterile plants in the canyon mouth at Northeast Anchorage (2843). Not previously reported from Guadalupe Island.

OENOTHERA MICRANTHA Hornem. Occasional in the canyon mouth at Northeast Anchorage (2891). Determination verified by P. A. Munz. Not previously reported from Guadalupe Island, whence the closely related but little-known *O. guadalupensis* S. Wats. was described. No *Oenothera* has been found before at this well-collected spot; and, moreover, it is here that many aliens have first been noted on the island. It therefore seems likely that *O. micrantha* is a new arrival.

NICOTIANA GLAUCA Graham. Well established in and about the canyon mouth at Northeast Anchorage (2838). Not previously reported from Guadalupe Island and doubtless a new arrival.

Bailey Hortorium, Cornell University,
Ithaca, New York

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